pected in the closely built-up sections of a city. Temperatures in the shade, 30 feet away, were not influenced by the pavements."

These tests were made in Riverside, Ill., far enough inland to escape the lake breeze and all the pavements were in the same vicinity. Weather conditions were ideal, as the sky was clear, and the air temperatures recorded at Chicago were the highest of the summer.

"For each pavement, readings were taken at the surface, 1 foot and 4 feet above, and 30 feet to one side of the roadway in the shade of a lawn. An additional set of readings was taken 4 feet over grass in the sun. Thirteen standard 25 cm. Fahrenheit thermometers were used, each protected from direct sunlight by a white paper or pasteboard cover. Readings were taken every half hour from 8 a. m. to 10 p. m."

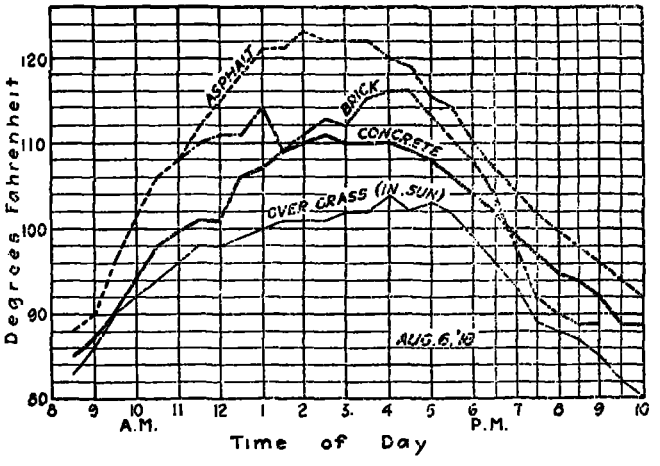

FIG. 1.—Surface temperatures for various types of surfacing.

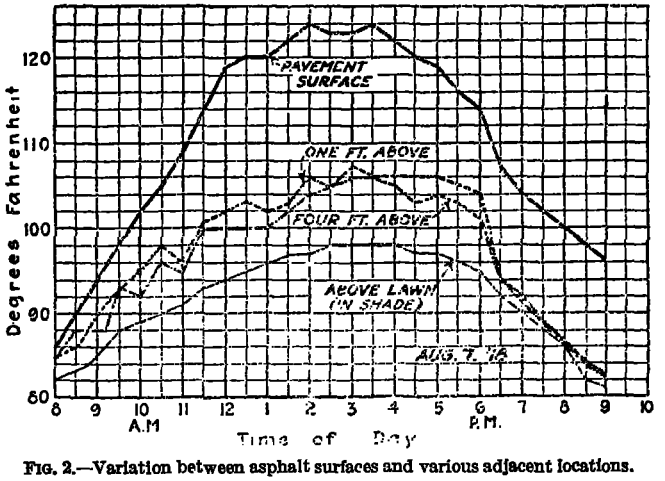

FIG. 2.—Variation between asphalt surfaces and various adjacent locations.

Figures 1 and 2 show sets of readings plotted between temperatures as ordinates and time of day as abcissae. "Figure 1 shows the difference between the various pavement surface temperatures and also the readings over a lawn in the sun. The drop in the brick temperature curve at 1:30 p. m. was due to the moving of the observation station on account of the encroachment of shade. No point could be found on the brick surface that was in the sun for the entire day. The rapid drop in the same curve between 6 and 8 p. m. was probably due to the proximity of the Des Plaines River, as air temperatures taken near showed a similar drop. Figure 2 shows the relation, for an asphalt pavement, between temperatures at the surface, 1 foot above, 4 feet above, and in the shade 30 feet to one side of the roadway."—*C. L. M.*

COMPARISON OF ROAD-SUBGRADE AND AIR TEMPERATURES.

By C. C. WILEY.

[Abstracted from Engineering News-Record, July 17, 1919, pp. 128-129.]

"Investigations were started at the University of Illinois in the belief that some of the phenomena of cracking and heaving of brick and concrete roads can be explained by a study of the range and rate of change in temperatures within the pavement and in the underlying soil. The observations will extend over a considerable period of time to obtain data concerning some of these factors." Preliminary records show that changes in temperature are transferred very slowly from the air to the subsoil, and that the subgrade extremes lag considerably behind those of the air.

"The fact that the changes of temperature at the bottom of the slab are considerably slower and much less in magnitude than those of the air may be worth considering in connection with protecting a new pavement from freezing. Also it may be noted that the change from maximum to minimum temperatures in the slab takes place over a considerable length of time, during which the slab and subgrade have an opportunity to adjust themselves to the changed conditions."—*C. L. M.*

PENETRATION OF PERIODIC TEMPERATURE WAVES INTO THE SOIL.

By K. AICHI.

[Reprinted from Science Abstracts, Sect., A, Mar. 31, 1919, § 240.]

The paper deals in a theoretical manner with the conduction of heat through a substance such as the soil. In working out the annual temperature wave at depths of 1 m., 2 m., and so on from that at the surface it is customary to assume the conductivity and specific heat constant throughout each layer. This is far from being the case, and it is shown that the assumption invalidates the results of such calculations. The ratio of the conductivity to the specific heat can be obtained (1) from the change of amplitude of the temperature wave with depth, and (2) from the retardation of phase, and in certain practical examples to which the formulæ are applied in the customary manner it is found that the results from (1) and (2) are in very poor agreement. In the paper certain cases where the conductivity varies with depth in a specified manner are treated mathematically.—*J. S. Di.*

NEW METHOD OF REDUCTION OF OBSERVATIONS OF UNDERGROUND TEMPERATURE.

By K. AICHI.

[Abstract reprinted from Science Abstracts, Apr. 30, 1919, p. 151. Art. in Phys.-Math. Soc., Japan, Proc. 1 (Ser. 3) pp. 2-7. Jan., 1919.]

A further discussion concerning the passage of the annual temperature wave downward through the soil, where the conductivity K and specific heat C vary with depth, see Abs. 240, 1919. If temperature observations were available at all depths, K and C could be calculated uniquely as functions of the depth, but actually, where observations at certain specified depths only are taken, a definite solution of the problem is not possible. Various methods of calculating the "equivalent diffusivity" of the layer between two points of observation are discussed and numerical examples are worked out.—*J. S. Di.*